Arc Flash Exercise 3

Purpose & Description

The purpose of this exercise is to perform an arc flash calculation using a small 50 bus system with a double ended configuration. This exercise illustrates the complex search mechanism used by ETAP Arc Flash to determine the Source Protective Devices (PD). This exercise also introduces the User-defined Source PD tool and how and when it should be applied. Some special settings and options which can help you solve AF calculations in complex systems are introduced as well.

Setup

Load the project file named “Arc Flash Example3”. The solution to this example is located in a directory called “Solution3”. Open the solution project only to compare against your exercise once completed.

Procedure

Step1

Run AF calculation using study case **AF MV** and configuration **Mult_Levels**. Name the report **AF1**. You will notice that the program returns the message “FCT not determined” for the arc fault at “Bus30”.

1.1 Identify only the first two source protective devices directly upstream from “Bus 30” which can interrupt an arc fault at “Bus30” for the selected configuration. (Clue: identify the upstream branch path(s) which actually energize the faulted equipment and find the PDs along the same)

First Upstream Device: ___________________________

Second Upstream Device: _________________________

1.2 Explain why the arc flash calculation did not select the FIRST upstream primary protective device to determine the fault clearing time and perform the arc flash evaluation at the secondary bus of transformer “T2”.

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1.3 The program did not select either the second upstream protective device as the source PD for a fault at “Bus30”. How many branch levels away is the second source upstream PD located?

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Step2

Open the ETAP Preferences Editor. To access this editor you can click on the Tools menu and select the option “Options (Preferences)…”

Identify the options related to the Arc Flash calculation and change the value of the option “Bus Levels Away To Find Source PD” to 15 instead of the default value of 10 and close the editor.

Re-run the Arc Flash calculation using study case **AF MV**, configuration **Mult_Levels** and output report AF2.

2.1 Was the program capable of determining the Arc Flash results? ___________ If yes, what is the arcing current magnitude passing through this device? ___________________ kA.

Step3

The previous two solutions did not account for the transformer fuse primary protection. Now select a fuse from the library for “Fuse5”. You may select the same fuse type as the one selected for “Fuse6”.

Run the Arc Flash calculation using study case **AF MV** and configuration **Mult_Levels** and name the output report **AF3**.

3.1 The incident energy at “Bus30” was reduced to what category after adding the library selection for “Fuse5”?

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Step4

Now open Bus30’s editor and go to the Arc Flash page. Select “Relay8” as the User-Defined Source Protective Device. Go to the AF MV study case AF page and click on the option “User-Defined Source PD (Bus Editor)”. Close the study case.

Now run the Arc Flash calculation using study case **AF MV** and configuration **Mult_Levels**. Name the output report **AF4**.

4.1 What hazard category does the program report for Bus30? ___________________________

4.2 What is the fault clearing time? ________________________ Sec.

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Step5

For a fault at buses “Bus20” and “Bus15” (generator terminal buses), the instantaneous protection has been turned off to coordinate the generator protection relays with downstream devices. The generator overcurrent protection is set to a longer time to coordinate with downstream devices. Introducing temporary reduced settings can help to reduce the incident energy exposure for arc faults near on the generator switchgear.

5.1 What is the incident energy value available for a fault at the generator switchgear with the current settings?____________________ cal/cm^2

5.2 If you temporarily turn on the instantaneous response of the generator relays you can reduce the incident energy at the switchgear buses to approximately = __________________cal/cm^2

Step6

Now switch to study case **AF LV** and run the AF calculation using configuration **Mult_Levels**. Name the output report **AF5**.

Observe the results for an arc fault at “Bus44”.

6.1 What is the minimum approach distance to the arc location for an incident energy exposure of 2 cal/cm^2? (Clue: use the Bus Arc Flash page for Bus44)

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Observe the results for the Low Voltage buses protected with Power Circuit Breakers tripped by relays. You will notice that the incident energy results at “Bus11” and “Bus5” yield a hazard category 4 and 3 respectively. These buses are fed from 1 MVA transformers.

6.2 If you increase the working distance for the tasks required to be performed while the equipment is energized to 36 inches, then the hazard category will be reduced to?

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